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November, 1789), "I should certainly have been able to announce its existence as early as August 19, 1787, when at $22^h\ 18^m\ 56^s$, I saw and marked it down as probably a sixth satellite, then about 12° past its greatest preceding elongation. . . . In the year 1788 very little could be done towards a discovery as my 20-feet speculum was so tarnished by zenith sweeps that I could hardly see the *Georgian* satellites. In hopes of great success with my 40-feet speculum I deferred the attack on *Saturn* till that should be finished, and having taken an early opportunity of directing it to *Saturn*, the very first moment I saw the planet, which was the 28th of last August, I was presented with a view of six of its satellites in such situations, and so bright as rendered it impossible to mistake or not to see them; and also on the 17th Sept. I detected the seventh satellite when at its greatest preceding elongation." In ascertaining the period of the sixth satellite, Herschel states that he used the 19th August, 1787, as a starting-point. Later he states that the seventh satellite "appears in the 40-feet, no bigger than a very small lucid point," yet he says, "I see it very well with the 20-feet reflector, to which the exquisite figure of the speculum not a little contributes." This is the account referred to in the former part of this paper.

It seems demonstrated then that though the satellite was seen in 1787 (as Hind also mentions), with the 20-feet telescope, it was not discovered in any proper sense of the word until August 28th, 1789, the instrument of the discovery being the 40-feet telescope. If the observation of 1787 is to be regarded as the discovery of the satellite, then by parity of reasoning Herschel did not discover *Uranus* nor did Galle observationally discover *Neptune*.

Note on the Densities of Jupiter's Satellites.

By Richard A. Proctor, B.A.

Incorrect values of the densities of *Jupiter's* satellites have somehow found their way into our text-books of astronomy, and have been repeated from one to another. They have led to erroneous assumptions respecting the condition of these bodies.

Thus, in Lardner's *Handbook*, we find the following table: —

Satellite.	Mass, that of Jupiter = 1.	Mass, that of Earth = 1.	Density, that of Earth = 1.	Density, that of Water = 1.
I	0·0000173	0·00520	0·02016	0·1143
II	0·0000232	0·00698	0·03015	0·1710
III	0·0000885	0·02663	0·06984	0·3960
IV	0·0000427	0·01285	0·03925	0·2225

It is strange that, though accepting different values of the satellites' diameters, Mr. Chambers, in his *Descriptive Astronomy*, gives the same values for the densities, only omitting the last decimal figure.

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Whence these values were originally derived I cannot say. They are unquestionably incorrect, and are, in fact, not even near the true values. This is easily shown in any given case. Thus take the second satellite, whose diameter is a little over 2000 miles, or about $\frac{1}{40}$th part of *Jupiter's* mean diameter. Then, if of equal density with *Jupiter*, its mass would be about $\frac{1}{64000}$th part of *Jupiter's*, or would be represented by 0·0000156. But Laplace's estimate of the mass of this satellite is 0·0000232, or more than half as great again as that resulting from a density only equalling *Jupiter's*. Hence the satellite's density is more than half as great again as *Jupiter's*. But *Jupiter's* density is represented by 0·24 if the Earth's is taken as unity; and by 1·36 if the density of water is taken as unity. Hence this satellite's density would be represented by more than 0·36, if Earth's equal 1, and by more than 2·04 if the density of water = 1.

So much to show that the values tabulated by Lardner and Chambers are erroneous whencesoever obtained.

The following values of the densities of the several satellites have been obtained by combining Laplace's estimates of the mass, with the values of the diameters given in the second column:—

Satellite.	Diameter in Miles.	Density, Earth as 1.	Density, Water as 1.
I	2352	0·198	1·148
II	2099	0·374	2·167
III	3436	0·325	1·883
IV	2926	0·253	1·468

It will be observed that all the satellites except the first thus appear to have a greater mean density than *Jupiter*. Probably their real densities are greater than those here tabulated, since irradiation would increase their apparent diameters.

Note on the Orbit of the Double Star Castor.
By J. M. Wilson, Esq.

The orbit of *Castor* appears to be hyperbolic, a form of orbit which, as far as I am aware, has not been shown to exist in the case of any binary system.* Mr. Gledhill was good enough to furnish me with a list of measures of *Castor*, extending from A.D. 1740 to the present time, and on charting these on a table of

* [It may be interesting to compare with Mr. Wilson's hyperbolic orbit the elliptic orbit deduced by Mr. Hind from all the observations with which he was acquainted, ranging over the period from 1718 to 1845. In the *Monthly Notices* for December 1845, Mr. Hind remarks that "the elements are entirely different from those previously computed by Sir John Herschel and M. Mädler; and this difference is materially owing to the great influence exerted by recent measures at Mr. Bishop's observatory, by Mr. Dawes." The results "are as follows" (we quote from a note by Mr. Dawes in vol. xxxv. of our

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